AMENDMENTS TO THE SPECIFICATION

Page 1, lin 1 to Page 2, line 2

A-1

FAST ETCHING SYSTEM AND PROCESS

Background of the Invention

Field of Invention

This invention pertains generally to etching and, more particularly, to a very fast etching system and process for use in the manufacture and backside etching of silicon wafers, integrated circuit packaging, and the manufacture of circuit boards.

Related Art

Historically, reactive ion etching, the prevalent method of plasma-based etching processes for integrated circuit (IC) manufacture, has used radio frequency electrical discharges between substantially parallel electrodes. The discharge produces ions and neutral reactive atoms and molecules that are responsible for the etching action. These etching processes were typically used in IC fabrication for silicon, silicon dioxide, silicon nitride or aluminum removal and used reactant gases containing fluorine or chlorine. Such processes have usually been anisotropic etching processes in which the material to be patterned was removed with the boundary being a plane substantially perpendicular to the wafer surface defined by a photolithographic mask. The typical removal rate of material for these processes was several thousand Angstroms per minute, adequate for the purposes of integrated circuit manufacture. The mask is made of photosensitive material - which is an organic polymer called photoresist. This etching process was called reactive ion etching (RIE) because it was the ions which provided the activation energy for the etching reactions, and the ions usually contained halogen atoms which formed volatile species upon reaction with the exposed material on the wafer. Under the conditions of the process, the ions from the plasma impact the wafer nearly perpendicular to the wafer surface activating reactions mostly on surfaces which are substantially parallel to the wafer surface and avoiding etching on surfaces which are perpendicular to the wafer surface.

Page 5, lines 25 - 26

Objects and Summary

A2

It is in general an object of the invention to provide a new and improved etching system and process.

Page 6, line 13 to Page 7, line 7

Brief Description of the Drawing

The single figure of drawing is side elevational view, somewhat schematic, of one embodiment of an etching system incorporating the invention.

A3

Detailed Description

The invention relates to the use for etching of a capacitively coupled radio frequency plasma discharge between substantially parallel electrodes using feed gas(es), at least one which is halogen, oxygen or hydrogen containing. The etching process rapidly etches silicon or organic polymers or adhesives, or other materials which may be composites or mixtures of organic and silicon-containing materials. The etching may be for any of several applications and thus may be mainly isotropic (equally fast in all directions) or substantially anisotropic (etching vertically when the substrate plane is horizontal). Such applications may include silicon wafer thinning for flash card or smart card use. A second would be silicon wafer production in which silicon is etched. Another might be etching of deep holes or trenches in wafers for integrated circuit manufacture. The invention could also be used for etching in making optoelectronic devices, or microelectromechanical systems. The process could also be used for fabrication of magnetoelectric devices; for etching encapsulants used in packaging of integrated circuit chips (either in individual packages or on substrate boards); for cleaning or microvia formation for multichip modules or for substrates used in packaging microchips or printed circuit boards; or for other microdevice fabrication processes. The key to the economic value and usefulness of this etching process in the stated applications is the very high etching rate, which at a minimum exceeds two to three microns of etching depth per minute and may for some materials and applications attain several tens of microns per minute.